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(54) Title: ABUSE-RESISTANT CONTROLLED-RELEASE OPIOID DOSAGE FORM

(57) Abstract: Abuse-resistant, controlled release opioid tablets in combination containing an opioid antagonist such as naloxone at a level above that needed to suppress the euphoric effect of the opioid, if the combination were crushed to break the controlled release properties causing the opioid and opioid antagonist to be released as a immediate release product as a single dose. The controlled release nature of the table prevents the accumulation of orally effective amounts of opioid antagonist when taken normally. The opioid antagonist is contained in a controlled-release matrix and released, over time, with the opioid.

ABUSE-RESISTANT CONTROLLED-RELEASE OPIOID DOSAGE FORM

This application claims benefit of priority to U. S. Provisional Application No. 60/290,439 filed on May 11, 2001.

FIELD OF THE INVENTION

The present invention relates to controlled-release analgesic pharmaceutical formulations. More specifically, the invention relates to abuse-deterring controlled-release analgesic tablets.

BACKGROUND OF THE RELATED ART

Opioid compounds have long been known both for their powerful analgesic properties, and for their strong potential for abuse. While highly effective at controlling pain, opioids can also be addictive. Abuse of opioids, particularly heroin, but also including morphine, codeine, oxycodone, hydromorphone, oxymorphone, and others, is a problem in modern society. Opioid addicts can obtain drugs from a variety of illicit sources. These street drugs are of questionable quality. Therefore, to potential abusers, prescription pharmaceutical opioids can be particularly attractive as a drug source because of their high purity and dependable dosage.

Abusers extract the pharmaceutical opioid, and other constituents, from the tablets. To do so, the tablets are crushed and often dissolved. The result may be further treated before it is ultimately injected or snorted to achieve a "high". This type of intravenous or intranasal abuse is well documented.

The potential for abuse of pharmaceutical opioids is not a new problem. To combat the effects of opioid abuse, opioid antagonists have been used to block the euphoria associated with opioid abuse, and to induce withdrawal symptoms in addicts. One opioid antagonist used previously, and even now, is naloxone. Naloxone is a powerful antagonist of the opioid receptor. Naloxone is highly effective when taken parenterally, but poorly effective when taken orally because of its metabolism in the liver and, thus, has a high oral:parenteral potency ratio. When injected in humans, amounts as small as 0.2-0.4 mg can block the opioid receptors and prevent the user from experiencing the drug's effects, whether analgesia or mood alteration, euphoria. Because of the high oral:parenteral potency ratio (~100) the antagonist action of oral doses of naloxone is much lower than the action of injections of naloxone. Because antagonists such as naloxone are less effective when taken orally, they have not been used to deter oral abuse and have been limited to deterring parenteral or intranasal abuse.

Recently however, a new form of abuse of opioid agonists has emerged involving oral abuse instead of abuse by injection or snorting. This practice has emerged largely because of the availability of high-opioid content controlled release (CR) formulations. "Chewing" involves crushing the opioid formulation and taking the entire contents, meant for 2 or more doses, at once. This practice releases all the opioid at once to generate a "high." The crushing may take place in the mouth as suggested by the name, but also may occur by other means to make the opioid readily available including, crushing or dissolving the tablet prior to injection or administered intransally.

Recently, high potency prescription opioid tablets containing large milligram doses of opioids have been introduced. These tablets are controlled release tablets and are designed to provide pain relief for 12 hours or more. Because the tablets have action over a long time period (12 hours instead of 4 hours for immediate release tablets), the tablets contain much higher quantities of opioid compounds. For potential abusers, these tablets are very attractive. Their high dosages make them a compact way to access large amounts of opioid. The fact that they are pharmaceuticals guarantees both the quality and quantity of drug in the tablet. Thus, the potential abuser knows he or she is obtaining a high purity drug in a known dosage. Prior oral opioid dosage formulations contained relatively low doses of opioid and were not generally targets for oral abuse. Their immediate release formulations release the opioid all at once, but with low amounts of opioid that would not be sufficient for oral abuse without putting several low dosage units together. In contrast, abusers have found that the new CR tablets contain large doses of opioid, which can be abused orally by chewing the tablets or crushing them to release all of the opioid at one time (immediate release). The present invention deters such oral abuse.

Oxycontin®, a controlled release oxycodone tablet from Purdue Pharma, is available in strengths as high as 160 mg oxycodone per tablet. The high opioid content makes these tablets especially attractive to abusers. Illegal trade in controlled release opioid tablets is becoming more prevalent. In order to obtain a euphoric effect (high) from such tablets, an abuser may crush the tablet and extract the opioid compound by dissolution for injection, or intranasal administration. Also, the abuser can achieve a euphoric effect from the drug by simply taking the drug orally, after chewing the tablet or grinding it to break the controlled release matrix and converting it to an immediate release product. Therefore, it would be desirable to have a formulation which would prevent the oral abuse of controlled release tablets if crushed to convert it to an immediate release product, without significantly affecting the analgesic action of opioid compounds in the intact controlled release tablet.

WO 01/58447 discloses pharmaceutical combinations of opioid agonists and antagonists in a controlled release matrix. The antagonist is present and released in amounts, over time, that attenuate or reduce the side effects of the opioid agonist, yet in amounts insufficient to block the opioid effect. The preferred antagonist is Naltrexone, which is highly effective when administered orally or parenterally. The antagonist is released only in very small amounts, 100-1000 times less than the opioid. WO '447 is silent with respect to including an anti-abusive amount of antagonist in the dose to prevent abuse. The intravenous use of small amounts of naloxone, 0.25 or 1 $\mu g\ kg^{-1}hr^{-1}$, is also disclosed as having attenuating effects.

WO '447 does not present release rates for the antagonist in its CR formulation, but directs those skilled in the art to the Crain patents (U.S. Patent Nos. 5,767,125; 5,580,876; 5,512,578; and 5,472,943). The Crain patents collectively disclose instant release formulations with "ultra-low" doses of certain antagonists to selectively block only the excitatory opioid receptors to attenuate opioid side effects, without blocking inhibitory receptors, which would lead to opioid blocking. These doses are on the order of pico-molar amounts. Crain '578 suggests that only naltrexone is useful in oral administration and that 1 μg doses are sufficient for attenuating opioid side effects by selectively blocking the excitatory opioid receptors and leaving the inhibitory opioid receptors free for receiving the opioid agonist (which may be administered in lower than normal doses with similar analgesic effect). The normal oral dose of naltrexone is about 50 mg versus "ultra low" does of 1 μg of naltrexone described in Crain '578 patent.

The prior art does not discuss controlled release formulation containing agonist and antagonist to deter abuse. Accordingly, there is a need for a composition that deters abuse in the high opioid-content controlled release formulation prevalent today.

SUMMARY OF THE INVENTION

Abuse-resistant, controlled release opioid tablets are a combination containing an opioid antagonist having a high oral:parenteral potency ratio (i.e. oral:parenteral > 1), such as naloxone, at a level insufficient to block the opioid effects or to attenuate the opioid side-effects in the controlled release formulation administered over an extended period, but above that needed to suppress the euphoric effect of the opioid if administered all at once. If the combination tablet is crushed to break the controlled release properties, the opioid and opioid antagonist is released as an immediate release product in a single dose, and the antagonist blocks the euphoric effects of the agonist. The opioid antagonist is contained in a controlled-release matrix and released over time, with the opioid agonist.

DETAILED DESCRIPTION OF THE INVENTION

The present invention employs the principle that certain opioid antagonists are ineffective in low oral doses. Therefore, one can administer a low oral dose over a long period of time (controlled release) from a tablet containing a large, orally effective amount of antagonist, without adversely affecting the action of the opioid. However, if the antagonist is administered all at once, it will block the opioid effect and may induce withdrawal in dependent individuals.

The present invention is intended for use in controlled release compositions. The term, "controlled release" or "CR" when used herein, is intended to refer to tablets intended to release an active pharmaceutical ingredient over an extended period of time, usually over 4 hours, generally 8-12 or up to 24 hours. One method of determining this is to check the intended dosing schedule. Any tablet intended to be taken less frequently than once every four hours should be considered controlled release regardless of labeling as controlled release, sustained release, extended release, etc. Often, these tablets contain polymeric matrices which may be cross-linked. Examples of such controlled release formulations are the Contin® system, produced by Purdue Fredrick Pharmaceuticals, or the TimerX® system by Pennwest Pharmaceuticals. Other controlled release polymers can also be used, such as methacrylate (Eudragit®), hydroxylpropyl methylcellulose (HPMC), or Carbopol®. The present invention may be used with these or other controlled release formulations.

The tablet of the present invention contains an opioid agonist in a controlled release matrix, along with an opioid antagonist. The antagonist is present at such a level, and dispensed at such a rate, that it will not block the action of the opioid agonist when an intact controlled release tablet is taken orally. Crushing the tablet will release sufficient antagonist all at once as an immediate release formulation to block the opioid response and also, induce abstinence. Antagonists need to reach an effective dose to work, so their slow release coupled with fast metabolism means they are maintained at ineffective, low levels in normal, recommended, therapeutic, non-abusive use. This low level of antagonist can be released over a long time period without affecting the therapeutic action of the opioid agonist. Even with sustained release over such long periods, the antagonist does not accumulate to blocking levels, since it is metabolized before it can accumulate to such levels. Because of the nature of the opioid antagonist action, the level of antagonist should be varied with the opioid dosage of the tablet. Also, depending on the antagonist, the oral:parenteral potency ratio, and the release rates, the levels of antagonists employed will vary. Regardless, there should be sufficient antagonist to block the opioid effect (high) and induce withdrawal in dependent individuals, if the tablet is

crushed, converting the formulation to immediate release. Under normal conditions, the release rate is not sufficient for blocking the opioid effect nor suitable for selectively blocking the excitatory opioid receptors to attenuate opioid side effects. For Naloxone, the presently preferred antagonist, it is believed that 15 mg (immediate release) should begin to block the opioid receptors and initiate withdrawal.

The specific opioid agonists, antagonists, CR matrices, and the combinations disclosed herein are merely exemplary. Other agonists, antagonists, matrices, and combinations may be used in conjunction with the teachings herein.

The opioid agonist can be any agonist in general use as an analgesic, including, but not limited to, morphine, oxycodone, levorphenol, meperdine, hydrocodone, codeine, dihydrocodeine, hydromorphone, propoxyphene, methadone, and oxymorphone. Specifically, any addictive opioid in a controlled release dosage form is the target of the present invention. Most particularly, controlled release oxycodone has recently been the target of abuse, and would therefore make a good candidate for use in the present invention. Of course, the release rate of the opioid agonist is established to achieve the desired analgesic effect.

Potency of the antagonist is measured as the oral:parenteral potency ratio, which indicates the amount of antagonist required orally to achieve an equivalent effect to an effective parenteral dose. For example, an antagonist having an oral:parenteral potency ratio of 10:1 requires 10 times the parenteral dose to be effective orally. The opioid antagonists used herein will have greater antagonistic effect when administered parenterally than when administered orally (oral:parenteral potency ratio >1). Accordingly, the desired antagonists block the opioid effect and induce withdrawal when administered at relatively low levels parenterally or intranasally. At the same time, these antagonists require relatively large levels to be effective when administered orally for recommended, therapeutic use. Thus, effective parenteral/intranasal doses are ineffective when administered orally. Preferably, the oral:parenteral potency ratio is at least approximately 10:1, more preferably at least approximately 25:1, and most preferably at least approximately 100:1 as is the case with Naloxone. Appropriate opioid antagonists having substantially greater effectiveness when administered by injection than when administered orally, include, but are not limited to: naloxone; naltrexone; N - cyclo propylmethyl - 7,8 - dihydro - 14- hydroxynormorphinone or 21 - cyclopropyl z, - (1 - hydroxy - 1 - methylethyl) - 6,14- endo - ethano - tetrahydrooripavine (or diphenorphine); and the pharmaceutically-acceptable salts thereof.

It has previously been known that opioid antagonists, such as naloxone, can block opioid receptors and reduce or eliminate the effect of opioids. Such antagonists are useful in treating opioid overdoses and to help treat addiction, in some cases. By blocking opioid receptors, the antagonists reverse and block the response to opioids. The high oral:parenteral potency ratio antagonists, such as naloxone, while very effective when injected, are significantly less effective when taken orally. Therefore, a dosage form designed for oral administration can have a significant amount of opioid antagonist, without adversely affecting the therapeutic efficacy of the opioid. Similarly, these levels of antagonists do not attenuate the side effects of the opioid. Such an antagonist would be effective in deterring intravenous or intranasal abuse when present in low levels, but would be ineffective in deterring oral abuse. Were the tablets to include sufficient antagonist to deter oral abuse, the antagonist would also reduce or inhibit the therapeutic efficacy of the drug. A tablet containing an orally effective amount of antagonists in a CR formulation releasing ineffective amounts of antagonist under normal use would be effective against both oral and parenteral abuse, without minimizing the effectiveness of the opioid under normal use.

The amount of antagonist in the composition will depend on the relative strength of the antagonist, the amount and strength of the opioid, the release rate of the antagonist, and the oral:parenteral potency ratio. In any event, the combination of antagonist type, oral:parenteral potency ratio, quantity, and release rate do not result in blockage of the opioid effect or attenuation of its side effects, when administered orally in its intended, intact dosage form.

Strengths of controlled release opioid tablets vary with the particular opioid used. In the case of oxycodone, strengths of 10, 20, 40, 80, and 160 mg may be used in a controlled release formula. The amount of opioid antagonist (such as naloxone) in such a tablet may also vary from about 2 mg to 40 mg or more. There should be at least 5 to 20 mg (preferably 10 to 20 mg) of naloxone in a tablet to prevent oral abuse by chewing a number of small, low dose tablets or a higher strength tablet. That is, the accumulation of an abusive dose by combining 2 or more low-dose tablets should also accumulate an effective amount of antagonist. Higher dose opioid tablets should contain an effective amount of antagonist without accumulation. Prevention of abuse by parenteral or intranasal administration will also be accomplished, since in the case of injection or snorting, only about 0.2 to 0.4 mg naloxone is needed to antagonize the opioid effect, to induce abstinence in dependent individuals, and to prevent abuse. Therefore the larger amount needed to prevent oral abuse will necessarily prevent abuse by injection or intranasal administration as well.

For oxycodone tablets of 10 or 20 mg tablet strength, the amount of naloxone, opioid antagonist used can range from 5 to 40 mg. As the tablet strength rises, the ratio of opioid to opioid antagonist varies from 1:3 to 4:1, since a 160 mg opioid tablet may contain 80 mg opioid antagonist. Although the ratio can vary, it is preferable to select one ratio for all tablet strengths. Physicians prefer to titrate patients using several low dose tablets which add up to the desired dosage. This is easiest if a constant ratio is maintained. Thus, a constant ratio across tablet strengths is useful even though that ratio can be any appropriate ratio in the range set forth above.

Drug abusers are creative when finding ways to defeat anti-abusive measures. Currently, several methods of oral abuse are contemplated. As discussed above, it should be remembered that the compositions of the invention contain sufficient antagonist to be effective orally and, therefore, necessarily contain a parenterally or intranasally effective blocking amount. Accordingly, parenteral and intranasal abuse are not discussed here.

Abusers may "chew" a single large dose tablet to achieve instant release of an abusive dose of opioid. Compositions containing these abusive amounts of opioid should contain enough antagonist to block oral abuse by "chewing."

Two or more lower dose tablets may be "chewed" together to achieve an abusive dose. To the extent that each tablet itself does not contain an orally, effective amount of antagonist, when combined to an abusive dose, the combined antagonist should be orally effective. That is if, for example, a 10mg tablet is not sufficient to achieve a high, it need not contain the full orally effective amount of antagonist. If two 10mg tablets are sufficient for a high, they then should contain a combined amount of antagonist which is effective orally for blocking the opioid effect.

Additionally, two or more high-dose tablets could be taken orally, without crushing, to achieve a "high." Such a combination would take advantage of the CR properties to sustain a high for the entire dosage period up to 12 hours. This type of abuse is uncommon since most abusers want the instant high or rush afforded by the immediate release of the crushed tablets. Such a combination, according to one embodiment of the invention, should also release a blocking amount of antagonist when taken orally without chewing. This arrangement would also prevent the dire effects of accidental overdose. Although this type of arrangement would be beneficial in many situations, it could limit a prescribing doctor's options, and therefore, may not be appropriate in all situations. Tablets according to this embodiment are not preferred, but are certainly within the scope of the invention.

Tablets according to the invention may take into consideration any of the above abusive regimes individually or any combination thereof.

The basic underlying premise of the invention is that the tablet contains 1) an amount of antagonist which is orally effective for blocking the opioid effect and 2) that the antagonist is available, normally, only at levels that are ineffective to block the opioid effect or to attenuate the opioid side-effects. One of the ways to achieve this is to control the release rate of the antagonist. The release rate of the antagonist is best thought of in terms of a percent of the release rate of the opioid agonist. The rate is controlled between approximately 100% - 0% of the release rate of the opioid, preferably 100%-25%. Table 1 shows release rates of opioid and antagonist as % released. In the case of 0%, the antagonist is never released unless the tablet is crushed. But, that is the subject of another application.

In the case of Naloxone, the short half-life (about one hour) ensures that the Naloxone does not accumulate to blocking levels, even when released at the same rate as the opioid. In slower release formulations (50% and 75%), the unreleased portion remaining after 10-12 hours passes to the large intestine where the absorption rate is much slower than in the stomach and small intestine. Accordingly, the amount of antagonist released beyond 10-12 hours does not contribute to any blocking or attenuating effect.

These release rates ensure that under normal usage the antagonist has no blocking or attenuating effect. Simultaneously, however, an orally effective blocking dose of the antagonist is present in the event that the CR properties are defeated.

The type and application of CR matrix used will determine release rates. Manipulation of release rates, even of two compounds with two different rates is - known in the art. Any known or later developed CR techniques may be used. It is important to remember though, that the antagonist should not be readily distinguishable or separable from the agonist, since would be abusers could possibly use mechanical separation techniques prior to defeating the CR formulation.

TABLE 1: Release Rates from CR formulation

		ANTAGONIST (as % of AGONIST release rate)		
	AGONIST	100%	50%	25%
1 HR	20-30 %	20-30%	10-15%	5-7.5%
4 HRS	60-70%	60-70%	30-35%	15-17.5%
10 HRS	>90%	>90%	45-50%	22.5-25%

Release rates are a percentage of agonist or antagonist with respect to its total content in the composition.

The tablets may be made by any traditional method of manufacture of controlled release tablets. Two principal processes are wet process (including wet granulation) and dry process (including direct mixing and roller compaction process.) Exemplary compositions for those processes are reproduced below.

TABLE 2: Preferred Naloxone Ranges for Differing Strengths of Oxycodone Tablets

Oxycodone (mg)	10	20	40	80	160
Naloxone (mg)	2-10	4-20	8-40	16-80	20-160

For oxymorphone, the doses for controlled release tablets may be 10, 20, or 40 mg and the naloxone dose ranges may be the same as set forth for oxycodone.

The preferred oxycodone:naloxone ratio is 5:1 to 1:1.

TABLE 3: Formula 1 of Oxycodone HCl 10-mg Tablets with Naloxone

Component	mg/Tablet	percent (by wt)
Oxycodone Hydrochloride	10.00	2.22%
Naloxone	10.00	2.22%
Lactose (spray-dried)	281.50	62.56%
Hydroxypropyl Methylcellulose, K100M	135.00	30.00%
Silicone Dioxide	9.00	2.00%
Magnesium Stearate	4.50	1.00%
Total:	450.00	100.00%

TABLE 4: Formula 2 of Oxycodone HCl 10-mg Tablets with Naloxone

Component	mg/Tablet	percent (by wt)
Oxycodone Hydrochloride	10.00	3.77%
Naloxone	10.00	3.77%
Lactose (spray-dried)	157.55	59.45%
Hydroxypropyl Methylcellulose, K100M	79.50	30.00%
Silicone Dioxide	5.30	2.00%
Magnesium Stearate	2.65	1.00%
Total:	265.00	100.00%

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TABLE 5: Formula 3 of Oxycodone HCl 10-mg Tablets with Naloxone

Component	mg/Tablet	percent (by wt)
Oxycodone Hydrochloride	10.00	8.33%
Naloxone	10.00	8.33%
Lactose (spray-dried)	60.40	50.33%
Hydroxypropyl Methylcellulose, K100M	36.00	30.00%
Silicone Dioxide	2.40	2.00%
Magnesium Stearate	1.20	1.00%
Total:	120.00	100.00%

Alternate compositions may also be used. Preferably, tablets according to the present invention will have the following compositions:

Material	Quantity (%)
Oxycodone Hydrochloride, USP	2.000-35.000
Naloxone	2.000-20.000
Microcrystalline Cellulose, NF (Avicel PH102)	10.000-50.000
Ammonio Methacrylate Copolymer, NF (Eudragit RSPO)	30.000-70.000
Colloidal Silicon Dioxide, NF (Cab-O-Sil)	0-5.000
Sodium Lauryl Sulfate, NF	0-5.000
Magnesium Hydroxide, USP	0-2.000
Povidone, USP	0-15.000
Stearic Acid, NF	0-5.000
Magnesium Stearate, NF	0-5.000

Dissolution was conducted according to USP XXIV Apparatus 3 (Reciprocating Cylinder) for Formulation 1-3. The apparatus 3 is to simulate the gastrointestinal conditions of human. The 1st hour is at pH 1.2 of 0.1N HCl. The 2nd and 3rd hours are at pH 4.5 of 10 mM of potassium phosphate monobasic. The conditions after the 3rd hours are at pH 6.8 of 10 mM of potassium phosphate monobasic. All dissolution vessels contain 250 mL of dissolution solution. The dip rate is set at 10 dips per minute. The bath temperature is set at 37.5°C. The HPLC parameters are set as follows: Column - Inertsil ODS 3, 50 mm x 4.6 mm, 3 µm particle size. Mobile phase: 80% 30 mM sodium hexanesulfonate pH 3.0 +/- 1, 20% acetonitrile. Injection volume is 75 µL. Column temperature is 35 °C, Flow rate is set at 1.0 mL/min. Wavelength is set at 225 nm. Run time is 5.5 minutes.

Dissolution results for Formulation 1-3 were as follows:

Formulation 1

Time	Tablet not Crushed		Tablet Crushed	
	% Oxycodone Dissolved	% Naloxone Dissolved	% Oxycodone Dissolved	% Naloxone Dissolved
0	0.0	0.0	0.0	0.0
1	29.8	27.8	88.2	94.6
2	47.8	45.4		
3	59.8	57.4		
4	68.5	65.9		
8	91.1	87.5		
12	100.7	97.9		

Formulation 2

Time	Tablet not Crushed		Tablet Crushed	
	% Oxycodone Dissolved	% Naloxone Dissolved	% Oxycodone Dissolved	% Naloxone Dissolved
0	0.0	0.0	0.0	0.0
1	40.1	37.0	104.9	102.8
2	63.2	60.3		
3	77.3	75.3		
4	86.5	85.2		
8	105.6	106.1		
12	110.5	112.6		

Formulation 3

Time	Tablet not Crushed		Tablet Crushed	
	% Oxycodone Dissolved	% Naloxone Dissolved	% Oxycodone Dissolved	% Naloxone Dissolved
0	0.0	0.0	0.0	0.0
1	59.0	52.5	100.5	90.9
2	85.4	78.0		
3	97.4	90.3		
4	102.5	95.9		
8	105.4	99.7		
12	105.4	99.8		

From these tests, it is evident that under normal, non-crushing use, the amount of antagonist, here naloxone, released over time is insufficient to block the opioid effect. Even Example 3, which has the highest initial release rate of antagonist, only makes about 5mg naloxone available in the first hour. Due to the short half-life of naloxone, and the slow release rate, the antagonist does not accumulate in the body to a level that blocks the opioid effect. On the other hand, in the crushed tablet, substantially all of the antagonist is available in the first hour. Thus, an opioid blocking amount of antagonist is readily available to deter oral and other forms of abuse. Regardless of the antagonist used, the combination of the antagonist content, the release rate, and the antagonist half-life achieves the goals of the invention to block the opioid effect when administered as for instant release, yet not blocking the opioid effect when administered as intended and recommended as a controlled release formulation.

It is well known that the various opioids have differing relative strengths. Often, these are compared and related to a standard for determining relative doses of each. Although this application discusses opioid content in terms of oxycodone, those skilled in the art will readily appreciate that other opioids, stronger and weaker, can be used in equivalent dosage amounts. Likewise, the antagonist is similarly selected and dosed.

The scope of the invention is not limited to the above examples, which are provided only for purposes of illustration. The above description is written in the context of a tablet. Other oral dosage forms, capable of being made in CR formulations may be used. Among the oral

dosage forms available are capsules, caplets, microspheres, gel caps and even liquid formulations.

CLAIMS

WHAT IS CLAIMED IS:

1. An oral pharmaceutical composition comprising:

a controlled release matrix;

an opioid agonist;

an opioid antagonist having greater antagonistic effect when administered parenterally than when administered orally;

wherein said opioid antagonist is present in the composition in an orally effective amount for blocking the opioid effect and/or inducing withdrawal when the controlled release matrix is defeated and the composition improperly administered for immediate release;

wherein said controlled release matrix is selected and incorporated for controlling the release rate of the opioid antagonist such that antagonist levels are not effective for blocking the opioid effect by blocking both the inhibitory and excitatory receptors or for attenuating opioid side effects by selectively blocking the excitatory receptors under proper oral administration regimes.

2. The pharmaceutical composition according to claim 1 wherein the release rate of the opioid antagonist is approximately 100 to approximately 25 percent of the release rate of the opioid agonist.

3. The pharmaceutical composition according to claim 1 wherein the release rate of the opioid antagonist is approximately 100 percent of the release rate of the opioid agonist.

4. The pharmaceutical composition according to claim 1 wherein the release rate of the opioid antagonist is approximately 50 percent of the release rate of the opioid agonist.

5. The pharmaceutical composition according to claim 1 wherein the release rate of the opioid antagonist is approximately 25 percent of the release rate of the opioid agonist.

6. The pharmaceutical composition according to claim 1 wherein the oral:parenteral potency ratio of the opioid antagonist is at least about 10:1.

7. The pharmaceutical composition according to claim 1 wherein the oral:parenteral potency ratio of the opioid antagonist is at least about 25:1.

8. The pharmaceutical composition according to claim 1 wherein the oral:parenteral potency ratio of the opioid antagonist is at least about 100:1.

9. The pharmaceutical composition according to claim 1, wherein said opioid agonist is selected from the group consisting of morphine, oxycodone, levorphenol, meperdine, hydrocodone, codeine, dihydrocodeine, hydromorphone, propoxyphene, methadone, and oxymorphone.

10. The pharmaceutical composition according to claim 1 wherein the opioid antagonist is selected from the group consisting of naloxone; naltrexone; N - cyclo propylmethyl - 7,8 - dihydro - 14- hydroxynormorphinone; and 21 - cyclopropyl z, - (1 - hydroxy - 1 - methylethyl) - 6,14- endo - ethano - tetrahydrooripavine (or diphenorphine) and the pharmaceutically-acceptable salts thereof.

11. The pharmaceutical composition according to claim 1 wherein said opioid antagonist is naloxone.

12. The pharmaceutical composition according to claim 1 wherein said opioid agonist is oxycodone.

13. The pharmaceutical composition according to claim 1 wherein said opioid agonist is present in concentration pharmaceutically equivalent to oxycodone doses of approximately 10-160mg.

14. The pharmaceutical composition according to Claim 1, wherein the release rate of the antagonist is such that a single dose of the composition does not render available an orally effective amount of antagonist, yet when two or more doses of the composition are combined – with or without crushing – to achieve an abusive dose of the opioid agonist, the opioid antagonist is available at orally effective blocking levels.

15. A pharmaceutical composition comprising:

a controlled release matrix;

an opioid agonist;

an opioid antagonist having greater antagonistic effect when administered parenterally than when administered orally;

wherein said opioid antagonist is present in the composition in an amount proportional to the number of abusive doses of the opioid agonist in the composition such that if the CR matrix is defeated and two or more doses of the composition are combined to yield an abusive dose of the opioid agonist, the amount of opioid antagonist will suffice to block the opioid effect and/or induce withdrawal when taken orally;

wherein said controlled release matrix is selected and incorporated for controlling the release rate of the opioid antagonist such that antagonist levels are not effective for blocking the opioid effect by blocking the inhibitory and excitatory receptors or attenuating opioid side effects by selectively blocking the excitatory receptors under proper oral administration regimes.

16. The pharmaceutical composition according to Claim 15, wherein the release rate of the antagonist is such that a single dose of the composition does not render available an orally effective amount of antagonist, yet when two or more doses of the composition are combined – with or without crushing – to achieve an abusive dose of the opioid agonist, the opioid antagonist is available at orally effective blocking levels.

17. An oral pharmaceutical composition comprising:

a controlled release matrix;

approximately 10-160 mg oxycodone;

approximately 2-160 mg naloxone;

wherein the ratio of oxycodone to naloxone is approximately 4-5:1 to 1:1;

wherein said controlled release matrix is selected and incorporated for controlling the release rate of the oxycodone for maintaining pharmaceutical effectiveness for a period up to 12 hours and for controlling the release rate of the naloxone such that naloxone levels are not effective for blocking the opioid effect by blocking both the inhibitory and excitatory receptors or for attenuating opioid side effects by selectively blocking the excitatory receptors under proper oral administration regimes.

18. An oral pharmaceutical composition comprising, in % by weight:

about 3-35% opioid agonist;

about 2-20% opioid antagonist;

about 10-50% microcrystalline cellulose, NF;

about 30-70% ammonio methacrylate copolymer, NF; and

at least one excipient selected from the group consisting of:

up to about 5% colloidal silicon dioxide, NF;

up to about 5% sodium lauryl sulfate, NF;

up to about 2% magnesium hydroxide, USP;

up to about 15% povidone, USP;

up to about 5% stearic acid, NF; and

up to about 5% magnesium stearate, NF;

wherein said composition is a controlled release formulation adapted to release the oxycodone at a therapeutically effective rate, and to release said naloxone at a rate ineffective for blocking the opioid effect and/or inducing withdrawal when the controlled release formulation is taken orally in intact form.

19. The oral pharmaceutical composition according to claim 18, wherein said opioid agonist is selected from the group consisting of morphine, oxycodone, levorphenol, meperdine, hydrocodone, codeine, dihydrocodeine, hydromorphone, propoxyphene, methadone, and oxymorphone and the opioid antagonist is selected from the group consisting of naloxone; naltrexone; N - cyclo propylmethyl - 7,8 - dihydro - 14- hydroxynormorphinone; and 21 - cyclopropyl z, - (1 - hydroxy - 1 - methylethyl) - 6,14- endo - ethano - tetrahydrooripavine (or diphenorphine) and the pharmaceutically-acceptable salts thereof.

20. The oral pharmaceutical composition according to claim 18 wherein said opioid agonist is oxycodone hydrochloride and said opioid antagonist is naloxone.

INTERNATIONAL SEARCH REPORT

Int Application No
PCT/US 02/15022

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61K9/20 A61K31/485 //(A61K31/485,31:485)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99 32119 A (EURO CELTIQUE SA ;KAIKO ROBERT F (US); COLUCCI ROBERT D (US)) 1 July 1999 (1999-07-01)	1-13,16, 19,20
Y	claims 1,4,7 table 1 page 23, line 8-10,17-19 page 14, line 1-18 page 30, line 30-32 page 34, line 5-8,16,17,23-25	17,18
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 October 2002	17/10/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Allnutt, S

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inte ll Application No
PCT/US 02/15022

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 01 58447 A (EURO CELTIQUE SA ;CURTIS WRIGHT (US); OSHLACK BENJAMIN (US)) 16 August 2001 (2001-08-16) cited in the application claims 1,13 page 8, line 27-31 page 6, line 23-26 page 9, line 19-31 page 27, line 21,22 examples 1,3 ---	1-3,9, 10, 12-16,18
Y	US 4 457 933 A (GORDON MAXWELL ET AL) 3 July 1984 (1984-07-03) column 4, line 5-7; claim 1 claim 1 column 2, line 31-35,50 -----	17,18

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

:ional application No.
PCT/US 02/15022

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 1-8, 14-18
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 1-8, 14-18

1. In claims 1,15,17 and 18 the expression "opioid agonist and opioid antagonist" is defined by reference to a desirable characteristic or property. This leads to a lack of clarity (Article 6 PCT) and is such as to render a meaningful search over the whole claimed scope impossible. Consequently, a search has been carried out for those clear, supported and concise claims i.e. the compounds defined in claims 9 and 10.
In addition, this term encompasses a very large number of possible compounds which may have this characteristic and a complete search is therefore not possible.
The applicants attention is drawn to the fact that some compounds may be already known to treat the diseases/disorders claimed by the applicant but are as yet not identified as opioid agonists or antagonists.

2. In claims 1 and 15 the expressions "having greater antagonistic effect.., for blocking the opioid effect and/or inducing withdrawal.., for controlling the release rate of the opioid antagonist..., for attenuating opioid side effect.." are defined by reference to a desirable characteristic or property. This leads to a lack of clarity (Article 6 PCT) and is such as to render a meaningful search over the whole claimed scope impossible.

3. Claims 2-5 relate to release rates of the pharmaceutical composition. The parameter being used can be seen as defining a result to be acheived. Comparison with prior art is impossible and therefore leads, prima facie, to a lack of clarity (Article 6 PCT) and is such as to render a meaningful search over the whole claimed scope impossible.
The same reasoning applies to claims 6-8 with respect to defining the claims as a parameter which cannot be compared to prior art.

4. The expressions "the opioid antagonist is present in the composition in an amount proportional to the number of abusive doses.....where the controlled release matrix is selected and incorporated for controlling..." in claims 15, 17, are defined by reference to a desirable characteristic

5. The expression "the release rate of the antagonist is such that ....." in claims 14 and 16 is defined by reference to a desirable characteristic or property. This leads to a lack of clarity (Article 6 PCT) and is such as to render a meaningful search over the whole claimed scope impossible.

Consequently the claims have been searched upon the basis of the defined opioid agonists and antagonist in claims 9 and 10 contained in a composition comprising a controlled release matrix.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

INTERNATIONAL SEARCH REPORT

ormation on patent family members

Int l Application No
PCT/US 02/15022

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